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Research article

Reaching the margins: Addressing demographic transition through EU Cohesion and Rural Development Policies in Italy

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Abstract
The impact of demographic decline on the allocation of policy instruments and public funding across territories has received limited attention. This study therefore identifies the key variables that influence the uptake of EU policies to clarify the conditions that may hinder the participation of declining territories in public programmes. This research is the first to jointly consider EU cohesion policy – through the European Regional Development Fund (ERDF) and the European Social Fund (ESF) – and rural development policy, financed by the European Agricultural Fund for Rural Development (EAFRD). A territorial typology of municipalities was adopted based on the EUROSTAT degree of urbanisation (DEGURBA) classification of urban–rural boundaries, combined with long-term demographic trends. This typology makes it possible to capture the differences between urban and rural areas, as well as the heterogeneity

within each group. We examined the influence of territorial typology and other explanatory variables on per capita spending under ERDF, ESF and EAFRD using spatial autoregressive models. The results reveal that demographic decline significantly undermines the capacity of rural areas to attract EU policies, as it progressively erodes the institutional strength of local authorities and the entrepreneurial ability of private actors to undertake investments and safeguard territorial capital over time.

Keywords: Demographic change, Rural areas, Cohesion policy, Rural development policy, spatial econometric models, impact territorial assessment.
JEL codes: R58, O18, Q18, J11.

Highlights:

- ERDF and ESF are predominantly allocated to urban areas, whereas EAFRD spending is mainly directed to rural municipalities.
- Rural areas demonstrate a higher capacity to absorb EAFRD per capita funding compared to ERDF across all demographic categories.
- In light of the 2028–2034 EU policy reform, the risk emerges that rural priorities – especially in demographically and economically fragile areas – may be underrepresented or deprioritised in the allocation of resources within the integrated national plans.

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1. Introduction

Demographic change has emerged as one of the key transitions currently facing the European Union (EU). Over the long term – since 1960 – the population of Europe has steadily increased, with the sole exception of the temporary decline during the COVID-19 pandemic. The total population rose from 354.5 million in 1960 to 450.4 million as of January 2025, an increase of 95.9 million. This growth, particularly evident in the last decade, has been driven primarily by a positive net migration rate, which has offset the negative natural population change.

In 2024, only six EU Member States – Sweden, Ireland, Luxembourg, France, Cyprus and Malta – recorded a positive natural population change, while positive net migration was observed across all EU countries. EUROSTAT (2021) has developed a classification of European countries (including European Free Trade Association-EFTA and candidate countries) based on the drivers of demographic change, distinguishing between population growth and decline, as well as the relative contribution of natural change and net migration. Two subgroups can be identified among countries experiencing population growth: one in which growth is driven by both positive net migration and natural increase (11 countries), and another in which net migration is the sole driver, with natural increase remaining negative (13 countries). Conversely, countries experiencing population decline – such as Italy – are characterised by insufficient net migration to offset the high negative natural change rate.

Depopulation is shaped by a combination of structural factors (OECD, 2025). First, fertility rates have consistently fallen below the replacement threshold. Across the EU-27, the average fertility rate declined from 1.54 children per woman in 2012 to 1.38 in 2023, with all Member States falling below the replacement level of 2.1. The lowest rates are observed in Italy, Spain, Poland, Latvia and Malta. This decline is attributable primarily to long-standing socio-economic and cultural dynamics. As noted by the OECD,

> *In a vicious cycle, places suffering from out-migration of youth will experience accelerated rates of ageing, high age dependency ratios and a declining share of population in reproduction age, leading to falling birth rates. These factors make it less attractive for the youth population and thus fuel further emigration of youth, lower birth rates, and more population decline (OECD, 2025).*

Population ageing, driven by increasing life expectancy, is the second major factor contributing to depopulation. While longer life spans represent one of the most significant demographic achievements of the 21st century, they also pose substantial challenges. The sustainability of this demographic shift depends on the strength of younger generations. A sharp decline in the youth population leads to imbalances in the ratio of the elderly to working age populations – a ratio that underpins economic productivity and the viability of social services. In the EU-27, the old-age dependency ratio rose markedly from 27.7 in 2012 to 33.9 in 2024, with Italy recording the highest value at 38.4.

Demographic change exhibits strong territorial dimensions, affecting regions and rural areas in differentiated ways (OECD, 2025). In the Italian context, regional disparities have widened between the Centre-North and the Mezzogiorno. Southern Italy is undergoing a more pronounced population decline and demographic imbalance, with an accelerated ageing process over recent decades. Once among the most prolific areas in Western Europe during the early post-war period, the Mezzogiorno reached fertility and demographic levels comparable to the national average by the early 21st century.

Birth rates and the presence of young people of working and reproductive age in the South have benefited less from foreign immigration, which has been more concentrated in central and northern regions. Internal migration towards the Centre-North has also intensified since the mid-1990s: between 1995 and 2008, approximately 1.7 million people – almost exclusively Italian citizens – moved from Southern Italy to the Centre-North (Rosina and Impicciatore, 2022). This trend has exacerbated territorial disparities, as increasingly dynamic and highly educated young individuals leave the South, thus contributing to the depletion of human capital and accelerating both population decline and ageing. This spiral results in a dual outflow – quantitative and qualitative – that undermines the region's capacity to reactivate development processes.

These dynamics become even more evident when examining intra-regional differences between urban areas, peri-urban zones, rural areas near urban centres and remote rural territories. Proximity to urban centres remains a key factor in analyses of demographic and socio-economic trends. The OECD classification is one of the most widely cited approaches to defining rural areas through an urban–rural relational lens; this classification considers the relationship between rural and urban centres and proximity to urban hubs as determinants of economic performance and development potential. Based on an indicator of closeness to urban centres, the OECD typology (Brezzi *et al.*, 2011) identifies five categories: (a) urban or predominantly urban regions; (b) intermediate regions close to an urban centre; (c) remote intermediate regions; (d) predominantly rural regions close to an urban centre; and (e) remote predominantly rural regions. This classification has been applied in official OECD reports and numerous academic studies, typically at the NUTS3 level.

However, demographic phenomena have a territorial granularity that requires analysis below the NUTS3 level. Using data at the local administrative unit (LAU) level allows for a more accurate exploration of demographic change, while avoiding the high heterogeneity associated with NUTS3-level analysis. More recently, Perpiña Castillo *et al.* (2024) have employed a set of indicators at the municipal level to explore the diversity among cities, towns and villages; rural areas close to cities; and remote rural areas. In Italy, further granularity is provided by the concept of "inner peripheries" as defined by the National Inner Areas Strategy (NIAS), which identifies remote areas based on their distance from essential service providers (e.g. primary and secondary schools, railway stations, healthcare facilities). The NIAS is a multi-fund policy specifically designed to counteract depopulation in areas with limited access to services. It classifies municipalities into four categories: (a) metropolitan poles; (b) inter-municipal poles; (c) peri-urban areas; and (d) inner areas, which include intermediate, peripheral and ultra-peripheral zones.

The migratory flow originating from inner areas and directed towards central areas (metropolitan zones, inter-municipal hubs and peri-urban areas) has been significant over the past 20 years. Nearly half of these departures (46.2%) come from inner areas in Southern Italy, 34.1% from those in the North and 19.7% from inner areas in Central Italy (ISTAT, 2024). Conversely, urban centres in the North receive most of these migrants (50.8%), followed by those in the South (25.9%) and Central Italy (23.3%). About half of the migrations from southern inner areas are directed towards central areas within the same southern region, while one-third head to central areas in the North, thus confirming the persistence of traditional south-to-north migration flows.

Foreign migration rates have been positive and, at least until 2012, have helped to offset internal migration outflows from these areas. After that date, however, foreign migration also stabilised at lower levels, which has resulted in a negative overall migration rate. After 2020, due to the COVID-19 pandemic and the subsequent return of residents, the net migration balance in inner areas became positive once again.

Over the past 20 years, the number of young Italian graduates who have moved from inner areas to central areas or abroad has steadily increased, while return flows have remained limited. According to ISTAT (2024), between 2020 and 2023, inner areas lost 132,000 young graduates to central areas and 28,000 to foreign countries. Overall, this represents a negative balance of 160,000 young graduates for the inner areas. The gap between inner areas and central areas has thus widened significantly over time, driven by a more pronounced decline in the youth population in inner areas. This decline is driven by both falling birth rates and the emigration of younger cohorts, which has been particularly intense in these territories.

In addition to the demographic effects, numerous studies have examined the socio-economic and environmental impacts of depopulation. Drawing on recent research (OECD, 2025; EC, 2020, 2023; Mantino *et al.*, 2024), several types of impacts can be identified. The first relates to the labour market, productivity and long-term growth, as population decline leads to a shrinking labour force, reduced market dynamism and lower propensity for innovation. The second is a reduction in the fiscal base, as depopulation diminishes the tax base and revenues from public service fees. The third encompasses effects on service and infrastructure delivery, as ageing and depopulation increase per-capita operating costs and shift service demand – reducing needs for education and public transport while increasing the demand for healthcare and elderly infrastructure. The fourth is governance and project development capacity, as the depletion of human resources in local governments undermines institutional capacity and the ability to design and implement development projects. The fifth impact is on civil society, because youth outmigration and shrinking public services weaken social cohesion and community vitality, thus fostering a sense of abandonment and growing distrust in institutions. The final impact is on the environment, as demographic shifts are closely linked to changes in land use. Land abandonment, a significant consequence of rural depopulation, is common in areas with steep terrain, low agricultural productivity or poor infrastructure. According to FAO (2020), abandonment patterns vary across Europe but often correlate with marginality and accessibility. The environmental outcomes are mixed: in some cases, abandonment increases risks such as wildfires, erosion and invasive species; in others, it promotes rewilding and carbon sequestration, ultimately enhancing biodiversity and ecosystem services.

Despite the growing relevance of demographic decline in the debates on territorial development, limited attention has been paid to its implications for the allocation and uptake of public policies and funding instruments across different types of territories. The present study addresses this gap by exploring which variables influence the use of EU policies and identifying the conditions that hinder the participation of specific areas – particularly those affected by demographic shrinkage – in public policy frameworks. While previous research has primarily focused on rural development policies (see Section 2), the novelty of this study lies in its integrated analysis of both cohesion policy instruments, namely the European Regional Development Fund (ERDF) and the European Social Fund (ESF), as well as rural development policy under the European Agricultural Fund for Rural Development (EAFRD). In doing so, the study examines the core components of the European Structural and Investment Funds (ESIF), the overarching objective of which is to reduce internal disparities in socio-economic and structural conditions among regions and territories, including rural–urban divides. The following questions guided the research:

a) What differences can be observed among the EAFRD, ERDF and ESF in explaining policy uptake in rural areas with varying demographic characteristics?
b) To what extent do demographic change and other territorial factors influence policy uptake, and what differences emerge among rural regions when analysed at a finer spatial scale?
c) Based on the findings for the previous questions, to what degree are EU structural policies contributing to the promotion of territorial cohesion?

2. Literature review

Participation in policy schemes – commonly referred to as the *policy uptake rate* – has been the subject of numerous studies in the academic literature, particularly during the second decade of the 2000s. These analyses have primarily focused on Rural Development Programme (RDP) measures, especially agri-environmental schemes (Bartolini *et al.*, 2012; Defrancesco *et al.*, 2008; Marconi *et al.*, 2015; Pascucci *et al.*, 2013; Yang *et al.*, 2014) and, in some cases, structural interventions such as those under Axis 1 (Pascucci *et al.*, 2013) and Axis 3 (Zasada and Piorr, 2015).

Econometric models have been employed to investigate the influence of various factors on policy uptake, which is treated as the dependent variable. In these models, policy uptake has been operationalized using three distinct types of indicators:

a) the percentage of farms benefiting from the policy scheme relative to the total number of farms in the region;
b) a binary variable, equal to 1 for recipient farms and 0 for non-recipient farms, typically used in logit regression models (Pascucci *et al.*, 2013; Defrancesco *et al.*, 2008); and
c) the amount of payments delivered per inhabitant or per hectare of utilised agricultural area (Marconi *et al.*, 2015; Yang *et al.*, 2014; Zasada and Piorr, 2015).

Indicator (c) is particularly suitable when the policy schemes target the broader rural population rather than a specific beneficiary category, such as farmers. It also facilitates comparative analysis across different types of EU funds. Indicator (b) is predominantly applied in studies of agri-environmental schemes, where comparisons between recipient and non-recipient farms are conducted using panel data. Indicators (a) and (c) are generally used when spatial data are available at the municipal level.

Demographic variables are included as explanatory factors in nearly all models. These are represented both by general population characteristics – such as population density, age group distribution and net migration rate – and by specific attributes of farmers, including age and the presence of a successor. Territorial typologies are also incorporated among the explanatory variables, in various forms, to capture differences in natural resource endowments and labour market conditions.

Several definitions of rural areas have been considered, including less-favoured areas, high nature-value areas and broader conceptualisations of territorial diversity, such as the urban/rural or accessibility/remoteness dichotomies (Öir *et al.*, 2020; Yang *et al.*, 2014, 2015). However, these variables often fail to yield statistically significant results in regression analyses.

Agricultural typologies have been examined from multiple perspectives, including farm structure, farm type, the share of agriculture in the local economy and agricultural productivity. For example, Pascucci *et al.* (2013) distinguish between internal factors – related to farm and farmer characteristics – and external factors, which include indicators of participation in professional and social networks. Zasada and Piorr (2015), in their analysis of participation and expenditure under Axis 3 measures, identify three categories of explanatory variables: farming community, landscape and rural community. The latter includes demographic and labour market indicators. Their study demonstrates that Axis 3 measures in the Brandenburg region] – such as tourism development and village renewal – primarily target rural areas characterised by structural weaknesses and vulnerability to demographic transition. A synoptic overview of these models is presented in Mantino *et al.* (2024).

In these models, limited attention has been paid to factors related to the efficiency of policy delivery mechanisms. To better understand the role of these specific dimensions, it is necessary to explore the literature on cohesion policy evaluation. The concept of *quality of government* has been extensively developed by Charron *et al.* (2014), who propose a set of indicators suitable for its measurement. This concept has been operationalised to assess the impact of cohesion policy programmes on regional economic outcomes, such as per capita income growth and economic convergence (Rodríguez-Pose and Garcilazo, 2013), as well as technological progress (Rodríguez-Pose and Di Cataldo, 2014); in both studies, the authors highlight a strong relationship among the quality of regional institutions, the capacity to absorb development funds and economic growth. However, operationalising the concept of government quality remains challenging, as it requires decomposing the notion of government into distinct components[1].

Moreover, the indicators commonly used in expenditure models at the European level suffer from significant limitations due to their high level of aggregation. These indicators often fail to capture substantial differences in spending efficiency across funds, programmes and categories of investment projects (European Parliament, 2019). Such limitations underscore the need for more disaggregated indicators explicitly linked to the administrative capacities of the managing authorities responsible for implementing EU funds and programmes.

3. Materials and methods

3.1. Defining a typology of demographic change

As previously discussed, demographic indicators have been widely used in EU-level research to investigate territorial disparities across European regions. A common analytical approach involves developing territorial classifications of rural areas experiencing population shrinkage (Copus *et al.*, 2020) and using demographic profiling based on long-term population

[1] According to Charon *et al.* (2010, p.9), these components include the rule of low, corruption, quality of bureaucracy or bureaucratic effectiveness, democracy and strength of electoral institutions.

trends (Colantoni *et al.*, 2020). These typologies are typically constructed by intersecting two key dimensions:

a) the temporal extent of population growth or decline, assessed over three or more decades to capture long-term patterns; and
b) the magnitude of demographic change, measured through average population variation across the entire observation period and categorised into defined classes.

Advanced studies benefit from access to highly disaggregated population data, ideally at the LAU level, which enables more precise spatial analysis. Building on these dimensions, a new classification of demographic change was developed using municipal-level data (see Table 1). The timeframe from 1991 to 2021 was segmented into three decades (1991–2001, 2001–2011 and 2011–2021), and three categories of temporal change were identified:

- Persistent population growth across all three decades.
- Mixed growth and decline over the decades, and
- Persistent population decline across all three decades

Four classes of average annual population change were then defined, distinguishing between rates of increase and decrease above or below the national medians for the period 1991–2021 (−0.59% for decline and +0.49% for growth). By intersecting the duration and magnitude of change (both positive and negative), five categories of long-term demographic change were identified (see Table 1).

Table 1. Typology of long-term demographic change

Number of decades between 1991 and 2021 and related trend	Annual rate of population change between 1991 and 2021			
	≤ −0.6	−0.59/0	0/+0.49	≥ +0.50
Growth over three decades			Resilient	Vital
Mixed growth and decline	Mixed		Mixed	
Decline over three decades	Very fragile	Fragile		

Source: Authors' own elaboration

These categories can be further distinguished according to the EUROSTAT classification of the degree of urbanisation (DEGURBA). According to this classification, individual municipalities can be grouped into two main categories: urban areas, including cities and towns and semi-dense areas, and rural areas[2]. The typology of demographic change is therefore disaggregated into five urban and five rural categories, yielding a total of 10 municipal types (see the population breakdown in Table 3).

3.2. The econometric model, variables and data used

[2] The classification process involves two main stages. Stage 1 classifies 1 km^2 grid cells based on population density and size into categories such as urban centres (high density and population), urban clusters (moderate density and population, excluding urban centres), and rural grid cells. Stage 2 then classifies small spatial units (like municipalities) into final categories: cities (majority population in an urban centre), towns and semi-dense areas (intermediate category), and rural areas (majority population in rural grid cells).

As highlighted in the literature review, various econometric approaches have been employed to investigate the determinants of policy uptake across territories. A key distinction emerges between aspatial models, which do not account for geographic relationships, and spatial econometric models, which explicitly incorporate spatial dependencies (LeSage, 1997). The latter have gained prominence in regional economics and policy evaluation, particularly for addressing issues of spatial autocorrelation – that is, the tendency for observations of the dependent variable or residuals to exhibit systematic spatial patterns. Anselin (2002) demonstrated that in the presence of spatial dependence, estimates derived from ordinary least squares regressions may be biased and inconsistent. To address this, two main types of spatial models are commonly used:

a) Spatial lag models, which include a spatially lagged dependent variable among the regressors. This formulation captures the idea that policy uptake in a given municipality may be influenced by uptake in neighbouring areas, reflecting potential spillover effects.
b) Spatial error models, which assume that spatial dependence is present in the error terms. This suggests that omitted variables shared across neighbouring units may be influencing the outcome, leading to correlated residuals.

Several studies have incorporated both forms of spatial dependence into their modelling frameworks (e.g. Bartolini *et al.*, 2012; Marconi *et al.*, 2015; Yang *et al.*, 2014), demonstrating the added explanatory power of spatial econometric techniques in territorial policy analysis. In terms of model specification, spatial autoregressive (SAR) models can be viewed as extensions of standard linear regression models that formally incorporate spatial relationships into the equation. This allows for a more accurate representation of territorial dynamics and interdependencies:

$$r = \rho\,(W1\ r) + X\,\beta + \varepsilon \qquad (1)$$

$$\varepsilon = \lambda\,(W2\ \varepsilon) + \mu \qquad (2)$$

where r is the observed participation rate, $W1$ and $W2$ are $n \times n$ standardised matrices of spatial weights applied, respectively, to the lag-dependent variable r and errors, X is the $n \times n$ matrix of k explanatory variables, ε is the error term, ρ is the spatial lag parameter, λ is the spatial error coefficient and β is the regression parameter. When $\rho = 0$ and $\lambda = 0$ in Equations (1) and (2), Equation (1) becomes a standard linear regression model; when $\rho = 0$, Equation (1) becomes a spatial error model; and finally, when $\lambda = 0$, Equation (1) becomes a spatial lag model.

In this study, the dependent variables representing policy uptake for each fund are defined as the committed expenditures per inhabitant at the municipal level, disaggregated by the ERDF, ESF and EAFRD schemes. The list of dependent variables used in the regression models is presented in Table 2, which also summarises the specific schemes included in the analysis for each dependent variable. Regression analyses were conducted separately for each fund and for homogeneous categories of investment support, with a particular focus on the distinction between measures aimed at sectoral competitiveness and those targeting territorial capital. This distinction is especially relevant for ERDF and EAFRD, as it allows for an exploration of whether significant differences in policy uptake emerge depending on the type of support provided. Understanding these differences is crucial for assessing the alignment between policy instruments and the demographic and territorial characteristics of the recipient areas.

Regarding the EAFRD, only investment schemes have been considered in this study, as the focus is on RDP support for investments in both the agricultural sector and the broader rural context during the 2014–2020 programming period. This choice ensures comparability with ERDF and ESF investment typologies. However, data on public and private expenditures by measure and sub-measure are not systematically available at either the national or regional level. This information gap necessitated an intensive and time-consuming effort to collect data from publicly available lists of approved and funded projects published by each region following the issuance of public calls. This data collection process enabled the compilation of detailed information on committed expenditures for approved projects, disaggregated by investment scheme type and municipality. It also included data on beneficiaries' residences and the time elapsed between the call opening date and project approval. In total, data were gathered from 1,352 calls across regional RDPs, representing the complete set of investment measures selected by regional administrations.

Table 2. List of dependent variables used in regressions

Variable name	Variable description	Support schemes included
ERDFpercapita	Committed expenditures by ERDF projects per inhabitant (Eur per capita)	All categories of measures envisaged by ERDF operational programmes
ESFpercapita	Committed expenditures by ESF projects per inhabitant (Eur per capita)	All categories of measures envisaged by ESF operational programmes
EARDFpercapita	Committed expenditures by EAFRD projects per inhabitant (Eur per capita)	M4 (farm and non-farm investments); M6 (start-up aids and non-agricultural activities); M7 (basic services and rural infrastructures); M8 (forest investments); M16 (Cooperation); M19 (LEADER)
ERDFcompetitiveness	Committed expenditures by ERDF projects for competitiveness per inhabitant (Eur per capita)	ERDF measures for industrial competitiveness, digital networks, research and development, transports and mobility
ERDFterritory	Committed expenditures by ERDF projects for service and infrastructures per inhabitant (Eur per capita)	ERDF measures for population services, inclusion and healthcare, culture and tourism, environment and energy
EAFRDcompetitiveness	Committed expenditures by EAFRD projects for competitiveness per inhabitant (Eur per capita)	EARFRD measures for farm investments, agri-food industry, young farmers, innovation in agriculture (M4.1; M4.2; M6.1; M6.2; M16)
EAFRDterritory	Committed expenditures by EAFRD projects for broader rural territory per inhabitant (Eur per capita)	EAFRD measures for rural infrastructures, non-productive investments, non-agricultural activities, basic services and local action group investments (M4.3; M4.4; M6.4; all M7; LEADER)

Source: Authors' own elaboration

For ERDF and ESF, data collection was facilitated by the availability of project-level datasets from OPENCOESIONE, which provides open and accessible data on the planning, implementation and financing of projects funded by European and national cohesion policy instruments during the 2014–2020 period. These include ESIF, the National Development and Cohesion Fund (Fondo per lo Sviluppo e la Coesione – FSC), and the Cohesion Action Plan (Piano d'Azione per la Coesione – PAC). The dataset includes information on committed and paid expenditures, beneficiary location and project implementation procedures.

The main limitations of the dataset used in this analysis concern the localisation of beneficiaries. First, not all ERDF and ESF projects are implemented within a single municipality; many have a broader territorial scope involving multiple municipalities. In such cases, there is no reliable criterion to allocate expenditures across the concerned municipalities, and these projects were excluded from the analysis. This exclusion led to the consideration of €16,224 million in ERDF and €7,144 million in ESF expenditures, representing 52% and 39%, respectively, of the total committed spending on Italy for the 2014–2020 period. For EAFRD, the data collection covered €3,484 million, corresponding to 55% of the committed spending on the same period.

By following the regression model described in equations (1) and (2), per capita expenditures of single Fund are dependent on a series of variables as in the following equations:

$$logYpc_i = \rho\ (W1\ logYpc_i) + \beta\ Dem_i + \gamma\ \Sigma X_i + \varepsilon \quad (1)$$

$$\varepsilon = \lambda\ (W2\ \varepsilon) + \mu \quad (2)$$

where $logYpc_i$ is the logarithm of the per capita expenditure in the i-th municipality, Dem_i is the demographic typology and ΣX_i is the set of variables included in the model. The list of explanatory variables is described in the Appendix.

The STATA programme was used to create the spatial weighting matrix *W*. We applied the same matrix *W* to the lag-dependent variable and errors (W1 = W2). *W* is a symmetrical matrix 7900 × 7900 (the number of Italian municipalities) and a contiguity matrix with the same positive weight for contiguous spatial municipalities and, by default, a zero weight for all other units. Municipal contiguity was taken into account in accordance with the communal code. *W* is also a spectral normalised matrix created by dividing the entries by the absolute value of the largest eigenvalue in the matrix (StataCorp, 2023). In practice, spectral normalisation produces estimates of ρ and λ in the range of −1 to +1 (with 0 meaning no spatial effects). To fit the model with endogenous regressors for cross-sectional data (as in the case of the independent variable), we used a generalised method of moments estimator known as generalised spatial two-stage least squares (GS2SLS) and STATA software version 18, which allows the estimation of all the regressor parameters jointly after creating the W matrix.

A complete list of explanatory variables is provided in the Appendix. Among the explanatory variables, how administrative efficiency was calculated requires clarification. In this study, we focused on the time elapsed between the call opening date and each project's approval date, expressed as the number of days per €1,000 of committed expenditure. This phase is considered crucial for assessing administrative performance. However, approval times may not solely reflect administrative efficiency, as they can also be influenced by factors such as project size (a proxy for investment complexity) and the number of applications received (representing the administration's workload).

To estimate the portion of approval time attributable to administrative efficiency, we employed the following regression model:

$$\text{Approval Time}_{ij} = \beta_0 + \beta_1 \cdot \text{ProjSize}_{ij} + \beta_2 \cdot \text{No.Applications}_{i\,j} + \varepsilon_{ij} \quad (5)$$

where the approval time for the *i*-th municipality and *j*-th fund is modelled as a function of project size and the number of submitted applications. The residual term ε_{ij} captures unexplained variation and is interpreted as the component of approval time potentially attributable to administrative efficiency. Specifically, the error term is the efficiency score, reflecting the difference between the actual approval time and the expected time based on observable factors. A negative residual indicates that the administration was faster than expected (i.e. an efficiency gain), while a positive residual suggests slower-than-expected performance (i.e. an efficiency loss). This approach allows us to derive an efficiency score for each municipality and fund, controlling for project complexity and administrative workload.

4. Results

This section first describes the characteristics of the typology adopted, which is based on demographic variables and the degree of urbanisation. It then presents the results obtained from the SAR econometric model.

4.1. Typologies of demographic change in Italy

Between 1991 and 2011, the Italian population increased by approximately 2.7 million, reaching 59.9 million in 2011. In the following decade (2011–2021), the population declined by just over 400,000 inhabitants (Table 3). This decrease affected rural areas almost exclusively, with a loss of around 584,000 inhabitants, partially offset by growth of approximately 150,000 in urban areas. The demographic weight of rural municipalities has steadily declined, dropping from 18.3% in 1991 to 17% in 2021. This loss has occurred primarily in the most vulnerable rural areas (classified as fragile and very fragile clusters), notably in mountainous and hilly regions. The classification also highlights the presence of weak urban-type municipalities, mainly located in hills and plains. Overall, the most demographically fragile municipalities – both rural and non-rural – accounted for just over 17% of the total population in 2021. If a portion of the "mixed rural and urban" category is also considered, this share could potentially reach up to one quarter of the Italian population.

Table 3. Evolution of the Italian population 1991–2021 by demographic type

Demographic typology	Population share 1991 (%)	Populatio n share 2011 (%)	Populatio n share 2021 (%)	Population change 1991–2011 (thousands inhabitants)	Population change 2011–2021 (thousands inhabitants)	Total area 2021 % Distribution by altitude zones			
						Mountain	Hill	Plain	Italy
URBANmunicipalities	*81.7*	*82.2*	*83.1*	2,474.8	151.7	*14.8*	*43.3*	*68.9*	*39.2*
Vital urban	*14.1*	*17.4*	*18.4*	2,349.9	536.6	*2.2*	*8.0*	*15.7*	*7.7*
Resilient urban	*4.3*	*4.4*	*4.6*	218.1	55.7	*0.5*	*2.8*	*5.3*	*2.6*
Mixed urban	*48.5*	*47.6*	*47.8*	733.1	-72.7	*9.3*	*23.9*	*36.9*	*21.8*
Fragile urban	*9.9*	*8.8*	*8.5*	-390.7	-222.2	*1.4*	*5.2*	*7.2*	*4.3*
Very fragile urban	*4.9*	*4.0*	*3.7*	-435.6	-145.6	*1.3*	*3.4*	*3.7*	*2.7*
RURAL municipalities	*18.3*	*17.8*	*16.9*	190.0	-583.9	*85.2*	*56.7*	*31.1*	*60.8*
Vital rural	*2.1*	*2.6*	*2.7*	379.2	74.7	*6.2*	*3.8*	*5.0*	*4.9*
Resilient rural	*0.5*	*0.5*	*0.5*	23.8	5.5	*2.9*	*0.5*	*0.9*	*1.4*
Mixed rural	*8.6*	*8.8*	*8.4*	389.9	-270.9	*28.9*	*25.4*	*17.0*	*24.7*
Fragile rural	*1.9*	*1.7*	*1.6*	-58.3	-73.4	*7.4*	*6.2*	*2.8*	*5.9*
Very fragile rural	*5.3*	*4.2*	*3.6*	-544.5	-319.8	*39.7*	*20.8*	*5.4*	*23.9*
Italy (1,000 inhabitants)	57.440	59.904	59.472	2.665	-432	7.193	23.251	29.027	59.472
Italy (%)	*100.0*	*100.0*	*100.0*	*4.6*	*-0.7*	*100.0*	*100.0*	*100.0*	*100.0*

Source: Authors' elaboration of Italian population census 1991, 2001, 2011 and 2021, Central Statistics Institute (ISTAT)

The main difference is that fragile rural municipalities are predominantly small or very small (Table 4). In contrast, fragile urban municipalities tend to be medium-sized and, in many cases, provincial or regional capitals. This pattern reflects an ongoing process of de-urbanisation affecting some medium- to large Italian cities. In recent decades, demographic fragility has become increasingly concentrated in Southern Italy, both in urban and – more markedly – in rural municipalities. Approximately 70% of the population residing in fragile urban municipalities is located in southern regions, and a similar proportion is found in very fragile rural municipalities in Southern Italy.

Table 4. Distribution of Italian population classes of municipal size and demographic type

Demographic typology	% Classes of municipal size and administrative role							% Total population 2021	% Population Share 2021 in South Italy
	less than 2000	2,000–5,000	5,001–20,000	20,001–50,000	Over 50,000	Provincial head city	Regional head city		
URBAN municipalities	*0.7*	*4.2*	*31.2*	*20.8*	*7.1*	*17.0*	*19.0*	*100.0*	*33.6*
Vital urban	*0.6*	*6.5*	*54.9*	*24.6*	*7.5*	*5.9*	*0.0*	*100.0*	*20.7*
Resilient urban	*0.3*	*2.4*	*36.2*	*40.2*	*4.9*	*11.7*	*4.4*	*100.0*	*22.4*
Mixed urban	*0.8*	*3.8*	*23.6*	*20.0*	*7.6*	*21.9*	*22.3*	*100.0*	*31.6*
Fragile urban	*0.4*	*2.3*	*23.8*	*11.9*	*4.5*	*17.9*	*39.2*	*100.0*	*70.4*
Very fragile urban	*0.9*	*3.0*	*23.0*	*8.9*	*8.3*	*12.6*	*43.2*	*100.0*	*53.3*
RURAL municipalities	*29.9*	*43.8*	*25.0*	*1.2*	*0.0*	*0.1*	*0.0*	*100.0*	*33.1*
Vital rural	*13.5*	*38.8*	*44.5*	*3.3*	*0.0*	*0.0*	*0.0*	*100.0*	*14.1*
Resilient rural	*18.4*	*41.9*	*39.7*	*0.0*	*0.0*	*0.0*	*0.0*	*100.0*	*22.9*
Mixed rural	*27.1*	*45.0*	*26.8*	*0.8*	*0.0*	*0.3*	*0.0*	*100.0*	*21.6*
Fragile rural	*28.8*	*49.1*	*20.0*	*2.1*	*0.0*	*0.0*	*0.0*	*100.0*	*46.7*
Very fragile rural	*50.7*	*42.9*	*6.5*	*0.0*	*0.0*	*0.0*	*0.0*	*100.0*	*69.4*
Italy	*5.6*	*10.9*	*30.2*	*17.5*	*5.9*	*14.1*	*15.8*	*100.0*	*33.5*

Source: Authors' elaboration of Italian population census 2021, Central Statistics Institute (ISTAT)

To address the research questions, it is first necessary to explore the actual distribution of funds (ERDF, ESF and EAFRD) across different types of municipalities (Table 5). In addition, within the EAFRD, we distinguished LEADER commitments from other RDP measures. Table 5 shows that ERDF and ESF are predominantly allocated to urban areas, whereas EAFRD expenditures are mainly directed to primary rural municipalities, and LEADER interventions more clearly target rural municipalities than any other fund.

Based on the demographic classification, the ERDF appears to address the needs of the most disadvantaged areas, with approximately one quarter of its resources allocated to fragile and very fragile urban municipalities. On the rural side, the needs of fragile and very fragile municipalities are primarily addressed by the EAFRD and particularly by the LEADER approach. However, it is essential to note that the financial resources available through EAFRD, especially LEADER, are significantly lower than those of the ERDF and ESF (Table 5).

Table 5. Distribution of European Structural and Investment Funds by demographic type in Italy in 2014–2020

Demographic typology	% Population 2021	% ERDF	% ESF	% EAFRD	% EAFRD-LEADER
Urban municipalities	*83.1*	*85.0*	*94.1*	*42.0*	*27.8*
Vital urban	*18.4*	*8.5*	*8.7*	*11.2*	*4.9*
Resilient urban	*4.6*	*3.0*	*3.6*	*3.2*	*0.9*
Mixed urban	*47.8*	*49.2*	*62.6*	*23.1*	*14.2*
Fragile urban	*8.5*	*19.7*	*13.1*	*2.6*	*5.3*
Very fragile urban	*3.7*	*4.5*	*6.0*	*1.8*	*2.5*
Rural Municipalities	*16.9*	*15.0*	*5.9*	*58.0*	*72.2*
Vital rural	*2.7*	*1.3*	*0.8*	*5.7*	*4.2*
Resilient rural	*0.5*	*0.6*	*0.8*	*1.3*	*0.8*
Mixed rural	*8.4*	*6.0*	*2.4*	*29.1*	*30.7*
Fragile rural	*1.6*	*1.4*	*0.5*	*5.4*	*8.1*
Very fragile rural	*3.6*	*5.7*	*1.4*	*16.6*	*28.5*
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*
Total (million Eur)		16.224	7.143	3.279	0.205

Source: Authors' elaboration of data from OPENCOESIONE (ERDF and ESF) and lists of projects approved by Regions (EAFRD)

4.2. The results of SAR econometric models

As previously discussed, multiple factors influence the uptake of EU funds. Table 6 presents the results of the SAR models estimating the uptake of the three main funds. The table also reports the estimated coefficients in logarithmic form, which indicate the marginal effect of each explanatory variable on policy uptake, along with their standard errors. To streamline the econometric analysis, specific municipal categories have been aggregated. Following the classification adopted in previous studies (e.g., Copus *et al.*, 2020), the "fragile" and "very fragile" categories have been grouped under the widely used label "shrinking urban/rural", while the "vital" and "resilient" categories are grouped as "growing urban/rural".

The pseudo-R^2 values are relatively good for per capita ERDF and EAFRD expenditures, while they are lower for ESF per capita spending. Both the rural–urban typology and demographic dynamics significantly influence fund absorption rates. Specifically, the various rural categories (growing, shrinking and mixed) exhibit a significant and positive association with the uptake of ERDF and EAFRD. In contrast, the coefficients for ESF are either statistically insignificant or negative (particularly for shrinking rural areas), reflecting the ESF's predominant focus on urban contexts (Table 6).

Rural areas demonstrate a higher capacity to absorb EAFRD per capita funding compared to ERDF across all demographic categories, as evidenced by the significantly larger estimated coefficients. This outcome can be attributed to the targeted nature of Italian RDP measures, which are specifically designed to support agricultural and rural beneficiaries – an approach not mirrored in the ERDF and ESF operational programmes. Notably, shrinking rural areas exhibit the highest per capita expenditure coefficients, a result reflecting the substantial allocation of rural development funds to agricultural regions in southern Italy, as well as the more favourable EU co-financing rates available to both agricultural and non-agricultural actors in lagging rural areas (Mantino *et al.*, 2022).

Being a provincial or regional capital emerges as a significant positive determinant of ERDF and ESF per capita expenditure, as indicated by the positive coefficients. In contrast, this variable is negatively associated with EAFRD spending, which suggests that such municipalities tend to be excluded from rural development funding. This pattern reflects the strategic orientation of ERDF and ESF, which tend to prioritise investments in infrastructure and socio-economic development within metropolitan and medium-sized urban areas (see also Münch *et al.*, 2024). Conversely, fund absorption appears to be negatively correlated with accessibility and broadband service, implying a priority of EU resources in regions facing greater challenges in accessing essential services – particularly in the Mezzogiorno. As expected, EAFRD per capita expenditure increases with the share of agricultural employment, while the relationship is negative for both ERDF and ESF, consistent with their broader development objectives. Furthermore, ERDF and ESF allocations are positively associated with municipalities characterised by higher shares of unemployed individuals and elderly populations, thus indicating a targeted response to socio-economic vulnerability.

Administrative efficiency also plays a critical role across all three funds. The negative sign of the coefficient suggests that shorter administrative processing times for project selection and approval are associated with higher per capita spending. Given the logarithmic specification of the model, the coefficients can be interpreted as elasticities: a 10% reduction in administrative delays is associated with an average increase in per capita spending of approximately 6% to 8%. This effect is particularly pronounced in the case of EAFRD, where disparities in administrative capacity among regional authorities are more substantial compared to those observed for ERDF and ESF.

The parameters ρ and λ, which respectively indicate the spatial dependence of the lagged dependent variable and the spatial correlation of the error terms, are positive and statistically significant across all estimated equations. This result confirms the presence of spatial effects and supports the adoption of a SAR model.

Table 6. Regressions outcomes of SAR models on the three EU funds

Independent variables	Dependent variable		
	Lg_ERDFpercapita	Lg_ESFpercapita	Lg_EAFRDpercapita
Constant	9.495***	-1352	24.45***
	(-1371)	(-1500)	(-1447)
Demographic typology			
- Growing urban	-0.0661	0.0539	-0.0666
	(0.0614)	(0.0645)	(0.0599)
- Shrinking urban	0.0682	-0.153	-0.0494
	(0.0910)	(0.101)	(0.0823)
- Growing rural	0.392***	-0.0307	0.787***
	(0.0837)	(0.0924)	(0.0680)
- Mixed rural	0.527***	-0.0781	0.877***
	(0.0571)	(0.0632)	(0.0491)
- Shrinking rural	0.794***	-0.188**	0.966***
	(0.0693)	(0.0790)	(0.0577)
Territorial disparities			
Capital_cities	0.734***	1.028***	-1.000***
	(0.134)	(0.140)	(0.116)
Lg_oldagerate	0.442***	1.350***	0.429***
	(0.0952)	(0.107)	(0.0782)
Lg_migrationrate	-0.233	-0.0829	-0.0953
	(0.172)	(0.205)	(0.117)
Lg_jobseekers	0.397***	0.337***	-0.312***
	(0.0548)	(0.0616)	(0.0450)
Lg_accessibility	-1.801***	0.214	-7.508***
	(0.384)	(0.405)	(0.476)
Lg_Broadband speed	-0.0787**	0.0368	-0.172***
	(0.0313)	(0.0351)	(0.0232)
Agricultural area			
Lg_shareagricarea	0.00405	-0.0915***	0.0602***
	(0.0236)	(0.0268)	(0.0197)
Lg_productivityha	-0.178***	0.0368	0.0310
	(0.0221)	(0.0246)	(0.0199)
Funds' efficiency			
Lg_Administrative efficiency	-0.611***	-0.639***	-0.839***
	(0.0128)	(0.0138)	(0.0175)
Spatial parameters			
Lg_ERDFpercapita	0.0952***	0.294***	0.0447***
	(0.0180)	(0.0298)	(0.0148)
e.Lg_ERDFpercapita	0.704***	0.879***	0.998***
	(0.0345)	(0.0402)	(0.0287)
Statistics			
Observations	4,957	4,040	4,796
Pseudo R^2	0.4094	0.3290	0.4747

Wald chi^2	2974.22	2863.17	4437.82
Prob > chi^2	0.0000	0.0000	0.0000

*** $p < .01$, ** $p < .05$, * $p < .1$.
Source: authors' elaborations from their own database and STATA processing procedures

Significant differences emerge when analysing investment categories within EU funds, particularly between competitiveness-oriented and territorial interventions (Table 7). In the case of ERDF competitiveness investments, the capacity to absorb higher levels of funding is more pronounced in capital cities than in rural municipalities, which reflects both stronger demand and greater investment capacity in urban contexts. This is further supported by the negative correlation with migration rates, which suggests that areas experiencing population decline are less able to mobilise competitiveness-related resources. In contrast, EAFRD competitiveness spending shows a positive association with shrinking rural areas, confirming the prioritisation of these territories within rural development strategies. Nonetheless, the coefficient linked to agricultural productivity indicates that competitiveness support is increasingly concentrated in areas with higher agricultural performance, suggesting a more effective use of EU funds in regions characterised by intensive farming systems.

Table 7. Regressions outcomes of SAR models on investment categories within ERDF and EAFRD

Independent variables	Dependent variable			
	Lg_ERDFCompetitiveness	Lg_EAFRDcompetitiveness	Lg_ERDFterritorypc	Lg_EAFRDterritorypc
Constant	7.173***	23.26***	11.25***	25.66***
	(-1483)	(-1858)	(-1762)	-1.886
Demographic typology				
- Growing urban	-0.00835	-0.201***	-0.508***	-0.0755
	(0.0629)	(0.0716)	(0.0948)	(0.0944)
- Shrinking urban	0.0617	0.0226	0.0946	0.0193
	(0.0943)	(0.108)	(0.122)	(0.115)
-Growing rural	0.258***	0.651***	0.460***	0.739***
	(0.0885)	(0.0821)	(0.125)	(0.104)
- Mixed rural	0.414***	0.774***	0.812***	1.104***
	(0.0603)	(0.0612)	(0.0832)	(0.0725)
- Shrinking rural	0.501***	0.965***	1.216***	1.232***
	(0.0756)	(0.0739)	(0.0954)	(0.0813)
Territorial disparities				
Capital_cities	0.742***	-1.062***	0.569***	-1.798***
	(0.136)	(0.134)	(0.150)	(0.156)
Lg_oldagerate	0.358***	0.128	0.419***	0.682***
	(0.103)	(0.0996)	(0.138)	(0.110)
Lg_migrationrate	-0.364*	-0.0283	-0.504**	-0.432**
	(0.203)	(0.153)	(0.248)	(0.177)
Lg_jobseekers	0.0289	-0.235***	0.119	-0.186***

	(0.0591)	(0.0579)	(0.0779)	(0.0602)
Lg_accessibility	-0.691*	-7.404***	-1.529***	-6.820***
	(0.397)	(0.621)	(0.449)	(0.599)
Lg _Broadband speed	-0.0571*	-0.222***	-0.104**	-0.189***
	(0.0345)	(0.0301)	(0.0438)	(0.0336)
Agricultural area				
Lg_shareagricarea	-0.0467*	0.119***	-0.0673*	-0.0972***
	(0.0252)	(0.0265)	(0.0367)	(0.0271)
Lg_productivityha	-0.141***	0.151***	-0.197***	-0.243***
	(0.0234)	(0.0253)	(0.0335)	(0.0276)
Funds' efficiency				
Lg_Administrative efficiency	-0.608***	-0.810***	-0.447***	-0.589***
	(0.0136)	(0.0227)	(0.0205)	(0.0272)
Spatial parameters				
Lg_ERDFpercapita	0.117***	0.0781***	0.0472*	0.106***
	(0.0226)	(0.0201)	(0.0274)	(0.0217)
e.Lg_ERDFpercapita	0.629***	0.986***	0.898***	0.849***
	(0.0414)	(0.0368)	(0.0433)	(0.0515)
Statistics				
Observations	4,275	3,526	2,770	3,036
Pseudo R^2	0.3544	0.4403	0.3463	0.4911
Wald chi^2	2271.00	2667.70	1113.17	2492.43
Prob > chi^2	0.0000	0.0000	0.0000	0.0000

*** $p < .01$, ** $p < .05$, * $p < .1$.
Source: authors' elaborations from their own database and STATA processing procedures

Territorial investments under both ERDF and EAFRD are positively correlated with indicators of socio-economic disadvantage. Municipalities associated with higher per capita spending typically exhibit demographic decline, limited accessibility and digital connectivity, elevated ageing indices, and lower productivity levels. Notably, only ERDF territorial investments maintain a positive correlation with capital city status.

The pursuit of more efficient project assessment and approval processes continues to demonstrate its relevance in enhancing policy uptake across all investment categories. The impact is particularly evident in EAFRD competitiveness expenditures, where substantial regional disparities in administrative efficiency – especially between the north and the south – translate into significant differences in fund absorption. These gaps highlight the potential for targeted improvements in administrative capacity to optimise the effectiveness of EU funding in lagging regions.

5. Discussion

Demographic change has emerged as one of the most pressing structural challenges in recent decades and is expected to remain a central transition for European countries in the coming years. In the Italian context, this transition manifests along two distinct territorial dimensions: (a) a north–south divide that reflects the more pronounced demographic decline observed in southern regions over the past decade; and (b) an urban–rural dimension, characterised by population shrinkage in many rural areas, particularly in peripheral and mountainous territories. These demographic dynamics impose significant constraints on economic development across the country, arising from the interplay between global transformations and localised socio-economic processes. This study adopted a territorial typology of municipalities based on the DEGURBA classification of urban–rural boundaries, combined with long-term demographic trends, which enabled a more nuanced analysis of territorial disparities, capturing not only the differences between urban and rural areas but also the heterogeneity within each category.

Using this framework, we analysed the distribution of EU funds across different municipal categories and estimated, through SAR models, the influence of territorial typology and other explanatory variables on per capita spending under the ERDF, ESF and EAFRD. The results reveal substantial differences among the three funds in terms of their territorial allocation. The ESF predominantly targets urban municipalities, while the EAFRD is more strongly oriented towards rural areas, particularly those experiencing demographic decline. The ERDF occupies an intermediate position: although it prioritises urban areas, it also allocates a non-negligible share of resources to declining municipalities, especially within the urban category.

In addition to confirming the descriptive findings, the econometric estimates provide a more nuanced understanding of the role of demographic characteristics within a multivariate framework. The use of SAR models is particularly appropriate in this context, as it mitigates the risk of biased and inconsistent coefficient estimates due to spatial autocorrelation. A comparative analysis of the econometric results across the three funds reveals that demographic decline does not constitute a barrier to EAFRD fund allocation. This outcome reflects the fund's explicit territorial targeting, which prioritises rural areas over urban and peri-urban areas. This pattern is especially evident in investments addressing broader territorial needs – such as support for non-agricultural activities and services for the rural population – while it is less pronounced in competitiveness-related investments, which tend to favour agriculturally productive areas with greater absorption capacity. In contrast, the ESF appears to follow an opposing logic, assigning lower priority to rural and demographically declining areas and concentrating its resources in urban contexts. The ERDF similarly favours urban municipalities, with declining rural areas exhibiting limited capacity to access funding, particularly for competitiveness-related interventions. However, in the case of territorial investments – such as infrastructure and service provision – there is a positive correlation between fund absorption and rural demographic decline, suggesting that these municipalities are better able to mobilise resources for such purposes.

Although the EAFRD is formally part of the Common Agricultural Policy (CAP), it is also recognised as a core component of the ESIF, alongside the ERDF, ESF, Cohesion Fund and European Maritime and Fisheries Fund. The Treaty of Lisbon (Article 174) underscores the objective of territorial cohesion, encompassing not only lagging regions but also rural areas and territories facing severe and permanent natural or demographic disadvantages, such as sparsely populated northern regions, islands, cross-border regions and mountainous areas. In this context, the findings of this study indicate that both the ERDF and EAFRD contribute to the overarching goal of reducing disparities in access to essential services and digital infrastructure. This is evidenced by the statistical significance and direction of the estimated coefficients across the three funds. However, more specific territorial disparities – whether between urban and rural areas or among municipalities with divergent demographic trajectories – are more consistently addressed by the EAFRD than by the ERDF. As for the ESF, both the expenditure analysis and regression results suggest a limited capacity to account for territorial disparities, likely due to the fund's predominant focus on labour market vulnerabilities rather than spatial inequalities. These conclusions are consistent with previous research (e.g. Crescenzi and Giua, 2016; Kline and Moretti, 2014), which highlighted the limited effectiveness of regional policies in the most disadvantaged areas, often attributable to weaker planning and advocacy capacities. This appears particularly evident in rural and demographically declining areas, where intra-regional disparities are most pronounced.

Demographic decline significantly undermines the capacity of rural areas to attract EU policies, as it progressively erodes the institutional strength of local authorities and the entrepreneurial ability of private actors to undertake investments and safeguard territorial capital over time. This progressive loss of capacity encompasses both public and private investments, generating a self-reinforcing vicious cycle in which each dimension adversely affects the other. The erosion of capacity is particularly acute in relation to competitiveness-oriented investments rather than territorial ones, given that private investments appear to be more sensitive to demographic contraction than public expenditure. Furthermore, the contraction in investment demand within rural areas is markedly more pronounced for ERDF and ESF resources than for EAFRD, owing to two main factors: (a) the structural difficulty for rural areas to compete with urban territories; and (b) the explicit targeting of rural areas by the EAFRD, in contrast to the broader scope of the ERDF and ESF.

Administrative efficiency emerges as a critical determinant in explaining regional disparities in the absorption of EU funds. This study highlights the need to move beyond generalized assessments of institutional quality at the regional level, advocating instead for a more granular analysis that considers the specific characteristics of each fund and the nature of the investments it supports. The findings suggest that institutional quality is not uniformly distributed within regions, challenging the common assumption of regional homogeneity in administrative capacity. This insight should be considered when designing interpretative models of EU policy impacts and when implementing administrative reforms to improve fund management and delivery.

Several methodological limitations should be acknowledged when interpreting the results of this study. First, the data collection process excluded projects with multi-municipal or supralocal scopes, particularly those with a multi-localisation code and broader territorial coverage. This limitation primarily affected urban areas, given the concentration of large-scale projects in metropolitan contexts. Second, the econometric analysis did not account for potential interactions among different EU funds and programmes. Previous studies (e.g. Crescenzi and Giua, 2016) have emphasised the importance of such complementarities, particularly between cohesion policy and the CAP. Finally, the analysis did not disaggregate results by macro-regional clusters (e.g. Northern, Central and Southern Italy), which could provide further insights into territorial heterogeneity and may represent a valuable direction for future research.

6. Conclusions and policy implications

Definitions of rurality at the European level have recently been standardised through the DEGURBA classification, which provides a harmonised framework for distinguishing urban and rural areas. Building on this framework, the present study integrated the concept of long-term demographic dynamics to refine the territorial typology employed in the analysis. By combining multiple data sources at the LAU level, this study identified a set of significant variables that influence the uptake of EU policies.

The conclusions outlined in the preceding section form the basis for a series of policy considerations, particularly in light of the European Commission's (EC's) recent proposals in July 2025 for the Multiannual Financial Framework (MFF) 2028–2034 and the associated reform of the EU policy architecture (EC, 2025a). These reflections aim to contribute to the ongoing debate on how to better align EU funding instruments with the evolving territorial and demographic challenges faced by Member States.

Among the key proposals outlined in the EC's Communication on the future Multiannual Financial Framework (MFF) 2028–2034 is the establishment of a single integrated fund which would consolidate previously pre-allocated instruments, including the ERDF, ESF+, Cohesion Fund, EAFRD, EAGF and EMFAF. This fund would be implemented through a single National and Regional Partnership Plan per Member State, with the aim of enhancing the strategic coherence, impact and efficiency of EU budgetary investments (EC, 2025b). The Commission highlights several expected improvements stemming from this reform, including greater flexibility in resource use, enhanced integration and coordination among funding instruments, and a shift towards more decentralised decision-making in the allocation of financial resources. However, this proposal has raised significant concerns within the European Parliament and among rural stakeholders, particularly regarding the future of support for rural areas. A key issue identified is the limited advocacy capacity of rural actors, which may place them at a disadvantage in a governance framework increasingly reliant on national-level intergovernmental negotiations. In such a context, the risk emerges that rural priorities – especially those of demographically and economically fragile areas – may be underrepresented or deprioritised in the allocation of resources within the integrated national plans.

As highlighted in the previous sections, even during the current programming period, urban areas continue to demonstrate a stronger capacity to absorb EU funds than rural areas. Looking ahead, the proposed reforms to the EU policy framework may pose significant challenges for rural areas in accessing both cohesion and rural development resources, particularly depending on the share of funding allocated to these areas at the national level. The proposed reduction of the agricultural budget – estimated at approximately €30 billion – also raises concerns about potential cuts to territorial investments, which are crucial for addressing structural and demographic challenges in rural regions. To mitigate the risk of exacerbating territorial disparities, it appears essential to align with the European Parliament's position, which advocates maintaining the two-pillar structure of the CAP. This structure ensures a balance between market and production-oriented measures under Pillar I and the social and territorial development objectives of Pillar II (Matthews, 2025).

In addition, the proposed Common Provisions Regulation (EC, 2025b) should incorporate more effective mechanisms for fund integration, specifically targeting shrinking rural areas. This includes reinforcing place-based approaches such as LEADER and Smart Villages and ensuring a minimum ring-fencing of resources for these areas within the broader National and Regional Partnership Plans. Such provisions are significant in light of the limited implementation of the community-led local development approach observed in several Member States during the current programming period (Kah *et al.*, 2023).

Another important policy implication concerns the potential application of this analytical framework within rural proofing (RP) methodologies. RP is the systematic assessment of policy measures and legislative proposals for their potential impact on rural areas. This approach is expected to be operationalised in the post-2027 EU policy framework, with the EC supporting its implementation across all Member States (EC, 2025c). The core objective of RP is to evaluate the distributive effects of policies that are not explicitly targeted at rural regions, but which may nonetheless exert a significant influence on their socio-economic and territorial development. In this regard, a robust analysis of the spatial allocation of EU funds, combined with an understanding of the key factors that influence it, constitutes a fundamental step in the RP process. Such evidence-based assessment is essential to ensure that broader policy decisions do not inadvertently disadvantage rural areas and that their specific needs are adequately addressed within the evolving EU policy architecture.

Author Contributions

Conceptualization: F.M. and G.D.F.; Methodology: F.M.; Software, Data Curation and validation: G.A.; Investigation: F.M and G.A.; Writing - Original Draft: F.M.; Writing – Review & Editing: F.M., G.D.F and G.A.; Funding Acquisition: F.M. and G.D.F; Resources: F.M. and G.D.F; Supervision: F.M.

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Appendix

Table A.1. List of independent variables (descriptions and statistics)

Variable name	Variable description	Min	Max	Mean	Standard deviation
Demographic typology					
Growing urban	Dummy variable = 1 if municipality belongs to growing urban group, 0 to the mixed urban	-	-	-	-
Shrinking urban	Dummy variable = 1 if municipality belongs to shrinking urban group, 0 to the mixed urban	-	-	-	-
Growing rural	Dummy variable = 1 if municipality belongs to growing rural group, 0 to the mixed urban	-	-	-	-
Mixed rural	Dummy variable = 1 if municipality belongs to mixed rural group, 0 to the mixed urban	-	-	-	-
Shrinking rural	Dummy variable = 1 if municipality belongs to shrinking rural group, 0 to the mixed urban				
Territorial disparities					
Capital_cities	Dummy variable= 1 if municipality is a capital city of region/province, 0 otherwise	-	-	-	-
Lg_accessibility	Weighted average index of the proximity to services of each municipality (2020)	-13.78	0.90	-0.21	0.70
Lg _Broadband speed	Broad band speed from the fixed network (Mb/s) at municipal level (2020)	0.18	475.95	56.18	44.27
Lg_migrationrate	Net total migration rate per 1,000 inhabitants at the municipal level (2021)	-133.33	102.15	2.53	12.93
Lg_jobseekers	People in search for a job per 1,000 inhabitants at the municipal level (2019)	0.00	17.49	5.22	2.40
Lg_oldagerate	Population >= 65/population 15–64 per 100 inhabitants (2021)	12.94	150.00	42.42	11.53
Agricultural area					
Lg_shareagricarea	Share of total agricultural area on municipal area (%, 2020)	0.00	100.00	49.76	35.64
Lg_productivityha	Average Agricultural Standard Output per farm (Euro) (year 2015)	284.0	3,074,000	50,152	97,268
Fund efficiency					
Lg_Administrative efficiency	Efficiency score ERDF calculated at the municipal level	-6.54	377.14	0.00	13.93
	Efficiency score ESF calculated at the municipal level	-207.49	417.61	0.00	129.28
	Efficiency score EAFRD calculated at the municipal level	-4.81	96.70	0.00	4.90

Source: All data are compiled from various sources like Central Institute of Statistics (ISTAT), OPENCOESIONE, own survey on EAFRD-funded projects.